

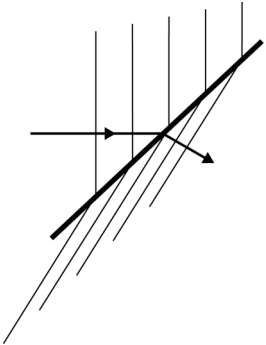
Assessment Schedule – 2006**Physics: Demonstrate understanding of waves (90254)****Evidence Statement**

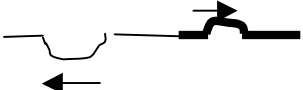
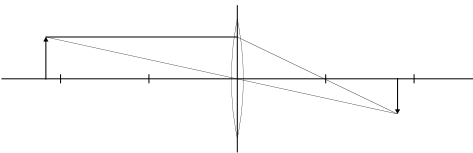
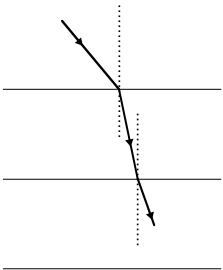
Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging
- the power of any number that is multiplied by a power of 10 is correct.

Correct units and significant figures are required only in the questions that specifically ask for them.

Working must be shown for Excellence and Merit

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
1(a) and 1(b)	 <p>The right-hand end of the waves slow down before the left-hand end. This causes the wave front to swing towards the normal.</p>	Arrow drawn correctly to show refracted wave direction. (A1)	Refracted wave fronts closer together and parallel to each other. (M1)	Merit plus correct explanation. (E1)
1(c)	Frequency stays the same. Wavelength decreases as speed decreases as $v = f\lambda$.	One correct statement. (A1)	Both parameters correct. (M1)	
1(d)	$F = \frac{8}{20}$ $F = 0.40 \text{ Hz}$	Correct. (A2)		
1(e)	Hz, s^{-1}	Both correct. (A1)		
1(f)	$V = f\lambda$ $\lambda = \frac{v}{f}$ $\lambda = \frac{2.8}{0.40}$ $\lambda = 7.0 \text{ m}$	Correct answer. (A2)		
1(g)	Sound waves diffract around barrier.	Correct answer. (A1)	This is because sound waves have a long wavelength. Light waves' short wavelength means they will not be diffracted. (M1)	

1(h)	Light waves are e/m waves / transverse / travel at $3.0 \times 10^8 \text{ ms}^{-1}$ / they do not need a medium. Sound waves are mechanical waves / need a material medium / longitudinal waves.	2 differences stated. (A1)		
1(i)		Phase correct for both transmitted and reflected pulse. (A1)	As for Achievement plus transmitted pulse closer to boundary. (M1)	
2(a)		Diagram drawn. (A1)		
2(b)	$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$ $d_i = (6^{-1} - 13.0^{-1})^{-1}$ $d_i = 11.14 \text{ cm} = 11 \text{ cm}$ $h_i = \frac{d_i}{d_o} \times h_o$ $h_i = \frac{11}{13} \times 2$ $h_i = 1.7 \text{ cm}$	Correct formula and substitution (A2).	Correct working and calculation for d_i . (M2)	Correct working and answer. (E2)
2(c)		Ray drawn correctly through one medium. (A1)	Ray drawn correctly through both oil and water. (M1)	
2(d)	$n_1 \sin \theta_1 = n_2 \sin \theta_2$ $\theta_2 = \sin^{-1}(1.00 \sin 40 \div 1.50) = 25.4^\circ$ $n_2 \sin \theta_2 = n_3 \sin \theta_3$ $\theta_3 = \sin^{-1}(1.50 \sin 25.4 \div 1.33) = 29^\circ$	Correct formula and substitution for initial calculation. (A2)	θ_2 calculated correctly. (M2) (Can be done without this step.)	All correct. (E2)
2(e)	Rays drawn correctly to show refraction. Image located.	Rays bend away from normal. (A1)	Correct rays and image. (M2)	
2(f)	Rays should travel from an optically dense to an optically less dense medium. The angle of incidence should be greater than critical angle.	One fact given. (A1)	Both aspects explained. (M1)	
2(g)	Critical angle of water = $n_1 \sin \theta_1 = n_2 \sin \theta_2$ $\theta_c = \sin^{-1}\left(\frac{1.0 \sin 90}{1.33}\right)$ $\theta_c = 48.75^\circ = 49^\circ$	Correct formula and substitution. (A2)	Critical angle calculated correctly. (M2)	
	2sf	Correct sf. (A2)		

2(h)	Antinode / constructive interference / reinforcement.	Correct answer. (A1)		
2(i)	The dark fringes on either side of the zero-order fringe are caused by destructive interference. Light from one slit travels a distance that is $\frac{1}{2}$ wavelength longer than the distance travelled by light from the other slit. Crests meet troughs at these locations.	One correct statement. (A1)	Links destructive interference due to a crest meeting a trough. (M1)	Links this to the distance travelled by the wave from one slit is $\frac{1}{2}$ wavelength longer, compared with the wave from the other slit. (E1)

Judgement Statement

Physics: Demonstrate understanding of waves (90254)

The grade awarded is the highest one that has been demonstrated in all achievement criteria up to and including that grade.

The following is a guide to the standard required for each grade in the two criteria.

	Achievement	Achievement with Merit	Achievement with Excellence
Criterion One	$5 \times A1$	$2 \times A1 + 5 \times M1$	$2 \times A1 + 5 \times M1 + 2 \times E1$
Criterion Two	$3 \times A2$	$1 \times A2 + 2 \times M2$	$2 \times M2 + 1 \times E2$